Amendments to the Specification

The paragraph starting at page 1, line 21 and ending at line 26 has been amended as follows.

Among them, the inkjet system ejects ~~and flies inks~~ flying ink droplets as a recording liquid from ejection ports acting as openings located at the extreme ends of the nozzles of a recording head (inkjet recording head) and executes recording by depositing the ~~inks~~ ink droplets on a recording member.

The paragraph starting at page 2, line 1 and ending at line 25 has been amended as follows.

In the recording apparatuses employing the inkjet system, it is conventionally known that the ejection ports of the recording head become clogged because the inks ejected from the ejection ports are evaporated, and thus a recorded state is deteriorated or it becomes difficult to execute recording in some cases. To suppress the evaporation of the inks, there is generally provided a mechanism for capping the ejection ports of the recording head using a capping member when the recording apparatus is not in operation. In the above arrangement, it is known to switch the recording apparatus between a closed state and an open state according to whether the recording apparatus is in a recording state or in a waiting state by a mechanism for relatively moving the capping member and the recording head so that the ejection ports are shut off ~~out of~~ from the

outside air by capping the ejection ports with the capping member by causing the capping member to come into intimate contact with the surface on which the ejection ports of the recording head are formed (referred to as the "cap closed state" or the "closed state") and that the capping member is separated from the surface on which the ejection ports are formed (referred to as the "cap open state" or the "open state").

The paragraph starting at page 2, line 26 and ending at page 3, line 22 has been amended as follows.

While the evaporation of inks is suppressed by the above mechanism of the cap, bubbles are gradually generated in the ~~inks~~ ink nozzles as a period elapses, whereby printing ~~defect~~ defects may be caused by the bubbles. Further, the viscosity of the inks in the ~~inks~~ ink nozzles increases as the period elapses, ~~thereby~~ whereby the printing ~~defect~~ defects may be caused. The phenomenon that the bubbles are generated in the nozzles as the period elapses is caused by the fact that a gas dissolved in the inks as a liquid appears as the bubbles. Further, deterioration of a printed state due to the printing defect is caused by the fact that inks are unstably ejected or are not ejected owing to the increase of the viscosity of the inks existing in the ejection ports of the nozzles and the fact that the color materials of the inks and the impurities in the inks precipitate around the ejection ports as a solvent in the inks evaporates. To cope with the deterioration of the printed state described above, many inkjet recording apparatuses employ a method of executing a print operation by recovering the recording head by forcibly sucking ~~an~~ the inks from the outside.

The paragraph starting at page 3, line 23 and ending at page 4, line 13 has been amended as follows.

In the recovery operation executed by sucking the inks, a large amount of the inks is discharged by executing the operation once. Thus, it is preferable to execute the recovery operation as less frequently as possible to reduce a consumed ink amount. This is because a running cost can be particularly suppressed as well as the capacity of a waste inks accommodation unit for accommodating ~~a~~ discharged inks can be reduced by suppressing the amount of the inks discharged by the recovery operation. For this purpose, it is known in conventional recording apparatuses to provide a timer or an arrangement for measuring a period similar to the timer with the recording apparatus, to measure a period elapsed from a last-executed suction ~~operation executed last time~~ operation, and to determine whether or not inks ~~is~~ are to be sucked according to the elapsed period.

The paragraph starting at page 5, line 1 and ending at line 18 has been amended as follows.

In the arrangement of the conventional recording apparatuses, since the period elapsed from the last-executed suction operation ~~executed last time~~ is measured based on the timing at which the suction operation is executed, there is not considered a case in which a degree of evaporation of inks differs depending on a state of the recording apparatus. Thus, there is case in which the ejecting state of the recording head cannot be

favorably recovered. Further, when preference is given to the recovery of the ejecting state of the recording head, it is contemplated to previously set to execute a suction recovery operation even if an elapsed period is relatively short, assuming that ~~an~~ the ink ~~is~~ has evaporated in a considerable amount. In this case, however, there is a possibility that the suction recovery operation is executed even if the operation is not necessary judging from the degree of evaporation of the inks.

The paragraph starting at page 6, line 1 and ending at line 11 has been amended as follows.

For example, when only black characters are continuously printed (for example, two or three hours) and then a color image is recorded, the nozzles for ejecting color inks are continuously kept in the cap open state without executing recording. In this case, the color materials and the impurities of the color inks precipitate around the color ~~inks~~ ink nozzles and may be crystallized depending on evaporating conditions. Accordingly, printing ~~defect~~ defects may be caused by these precipitants and the crystallization of the color materials and impurities.

The paragraph starting at page 6, line 12 and ending at line 23 has been amended as follows.

Likewise, a special sheet such as a glossy medium is generally controlled such that it is not printed with a black pigment. When, however, an image is recorded on the special sheet by color ~~print~~ printing (for example, continuously for two to three hours) and then characters are printed using the black pigment, the nozzles for ejecting ~~an inks~~ the ink containing the black pigment are continuously kept in the cap open state without executing recording. As a result, the nozzles are clogged by the adhesion of the inks whose viscosity is increased because the inks are dried, thereby printing ~~defect is occurred~~ defects occur.

The paragraph starting at page 7, line 5 and ending at line 16 has been amended as follows.

As described above, the cap of the nozzles for ejecting a certain ink may be continuously kept in the open state depending on a recording operation. Inks are evaporated and dried and precipitants are produced in an elapsed period in ~~a~~ different ~~degree~~ degrees, depending on whether the cap is opened or closed. Accordingly, the conventional arrangement for determining the execution of the suction recovery operation based on the elapsed period has a problem in that inks are wastefully consumed in the suction recovery operation and that defective ejection ~~is occurred~~ occurs more frequently.

The paragraph starting at page 11, line 12 and ending at line 24 has been amended as follows.

In FIG. 1, the recording head 21 and ink tanks 22, in which the inks to be supplied to the recording head 21 are stored, are detachably mounted on the carriage 20. The carriage 20 is slidably engaged with a scanning rail 33 as well as supplied with drive force from a carriage motor 73 (refer to FIG. 5) through a transmission mechanism such as a belt ~~and~~ or the like so as to enable the recording head 21 to execute scanning. Further, a recovery system 50 is disposed at an end of the moving range of the carriage 20 to execute ejection recovery processing to maintain the ejecting function of the recording head 21 in a good state.

The paragraph starting at page 13, line 3 and ending at line 14 has been amended as follows.

In FIG. 2, reference numeral 24 denotes a shaft receiving portion of the carriage 20 through which the carriage 20 is engaged with the scanning rail 33. Further, reference numeral 40 denotes a cap capable of covering the ejecting port surface of the recording head 21. The cap 40 can be moved by ~~a not shown~~ an unshown mechanism (upward/downward moving mechanism) along the direction of an arrow A. When the carriage 20 is positioned above the recovery system disposed at a home position, the cap 40 moves upward and comes into intimate contact with the ejecting port surface and is separated therefrom by moving downward.

The paragraph starting at page 13, line 15 and ending at page 14, line 14 has been amended as follows.

Further, in FIG. 2, reference numeral 56 denotes a suction tube for communicating with the cap, 57 denotes an atmosphere communication tube for communicating with the cap, and 58 denotes an atmosphere communication valve coupled with the atmosphere communication tube 57. The atmosphere communication valve can be opened and closed by ~~a not shown~~ an unshown cam mechanism. Reference numeral 52 denotes a suction pump arranged as a tube pump. Reference numeral 51 denotes a pump base having a tube guide surface 51a formed on the inside thereof in a semi-circular shape. Reference numeral 53 denotes a roller holder having two rollers 55 for generating negative pressure in the cap 40 in such a manner that the two rollers 55 rotate along the tube guide surface 51a of the pump base 55 about a rotating shaft 54 while squeezing the suction tube 56. Reference numeral 70 denotes a blade, and 71 denotes a blade holder for holding the blade 70. When the cap 40 moves downward and waits, the blade 70 of the blade holder 71 slides on the ejecting port surface 21a of the recording head 21 in the direction of an arrow B to thereby wipe ~~dusts~~ debris such as dust, ink droplets, paper powder, and the like, remaining on the ejecting port surface 21a in abutment with the ejecting port surface 21a.

The paragraph starting at page 16, line 12 and ending at page 17, line 13 has been amended as follows.

The central processing unit 60 includes a program ROM 61 for storing a control program and a random access memory (RAM) 62 for storing various data such as print data to be supplied to the recording head 20. The central processing unit 60 supplies proper recording conditions to the carriage control circuit 76, the sheet conveying control circuit 77, and the head driving control circuit 78 in response to input information and executes recording by driving a carriage motor 73, a conveying motor 74, and the recording head 21. The ROM 61 also stores a program for executing a recovery operation timing chart (to be described later) and executes a recovery operation by supplying control conditions to the recovery system control circuit 67 and the head driving control circuit 78 when necessary (for example, in response to a command for executing a suction recovery operation supplied from the operation unit 66). The recovery system control circuit 67 drives a recovery system motor 68, and operates the cap 40, the atmosphere communication valve 58, the blade 70, and the suction pump 52 through ~~a not shown~~ an unshown cam mechanism, and the like, and the head driving control circuit 78, which drives the electrothermal ~~transducer~~ transducers of the recording head 21, ejects inks in recording as well as preliminarily ejects inks. With the above arrangement, the recovery operation described below can be executed.

The paragraph starting at page 17, line 22 and ending at page 18, line 5 has been amended as follows.

Further, the embodiments of the present invention have been described as to the arrangement in which one cap is employed for the convenience of description. However, the present invention is not limited to the above arrangement and can be applied to an arrangement in which a plurality of caps are provided and execute a suction operation, respectively. Further, the present invention can be also applied to an arrangement in which ~~only~~ any of a plurality of caps executes the suction operation.

The paragraph starting at page 18, line 6 and ending at line 10 has been amended as follows.

Further, <u>although</u> the pump necessary for the suction operation has been described as ~~to~~ the tube pump as an example, the pump is not particularly limited to the tube pump, and any pump may be employed as long as it can generate negative pressure in the cap.

The paragraph starting at page 20, line 8 and ending at page 21, line 3 has been amended as follows.

A straight line C of FIG. 6 shows the relationship between a consumed ink amount for each liquid room and a cap-open period when only timer preliminary ejection is executed. That is, when the consumed ink amount is below the straight line C at the time the threshold value Th is exceeded in the state in which the cap is opened, clogging ~~is~~

~~occurred~~ occurs by the precipitation of adhered inks and impurities in the vicinities of the nozzles. That is, clogging occurs when the consumed ink amount in a predetermined period is less than the amount of ink that must be consumed to prevent clogging. It has been found by experiment that when the cap-open period exceeds about two hours, adhesion of evaporated inks and crystallization of impurities begin. Accordingly, the predetermined threshold value Th is set to two hours, and when the cap-open period exceeds two hours, a predetermine amount of ink (about 0.13 g) is sucked for recovery. A straight line B in FIG. 6 shows the relationship between a consumed ink amount for each liquid room and a cap-open period at that time.

The paragraph starting at page 22, line 12 and ending at line 18 has been amended as follows.

With the above operation, when recording is executed using only certain particular nozzles, inks can be refreshed by executing the suction, thereby it is possible to prevent occurrence of printing ~~defect~~ defects caused by the adhesion of evaporated inks and crystallization of impurities in the vicinities of unused nozzles.

The paragraph starting at page 24, line 22 and ending at page 25, line 5 has been amended as follows.

Further, in order to ~~more~~ <u>further</u> reduce the ink amount consumed by the suction recovery, when the predetermined period Th has ~~been~~ elapsed and the number of dots D has not yet exceeded the predetermined number of dots Dh, the amount of ink to be sucked in the recovery suction is set to the amount obtained by subtracting the number of dots D from the predetermined number of dots Dh (Dh - D), and the suction recovery operation may be controlled according to the set suction amount.

The paragraph starting at page 25, line 6 and ending at line 12 has been amended as follows.

With the above arrangement, since the suction recovery operation need not be executed more ~~frequency~~ <u>frequently</u> than necessary while executing the operation the necessary number of times, the consumed ink amount can be suppressed as well as the reliability of the apparatus can be improved while maintaining a printed state of high quality.

The paragraph starting at page 26, line 14 and ending at page 27, line 1 has been amended as follows.

First, at step S905, it is determined whether or not the cap-open elapsed period T is equal to or more than the predetermined threshold value Th. When $T \geq Th$, the process goes to step S912, and when all the numbers of dots of C, M, Y are larger than the

predetermined number of dots Dh, the process goes to step S914, whereas when any one of the numbers of dots is less than the predetermined number of dots Dh, the process goes to step S913. At step ~~S914~~ S913, the recovery suction is executed and inks are refreshed, and the process goes to next step S914. At step S914, the cap-open timer is reset. Next, at step S915, the dot counter is reset, and the process goes to step ~~S916~~ S906 to continuously execute the sequence.

The paragraph starting at page 27, line 2 and ending at line 6 has been amended as follows.

With the above operation, even if a particular cap or ~~a~~ ink is used less frequently, occurrence of printing ~~defect~~ defects in the vicinities of the nozzles due to adhesion of evaporated inks and crystallization of impurities can be prevented.